## Original Article

# Comparison of neurological clinical manifestation in patients with hemorrhagic and ischemic stroke

Seyedhossein Ojaghihaghighi[1], Samad Shams Vahdati[2], Akram Mikaeilpour[3], Ali Ramouz[4]

[1] *Emergency Medicine Deparmtent, Tabriz University of Medical Science, Tabriz, Iran*

[2] *Road Traffic Injury Research Center, Tabriz University of Medical Science, Tabriz, Iran*

[3] *Tabriz University of Medical Science, Tabriz, Iran*

[4] *Medicine Faculty and Student Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran*

***Corresponding Author:*** *Samad Shams Vahdati, Email: sshamsv@yahoo.com*

**BACKGROUND:** Cerebrovascular accident (CVA) is the third leading cause of death and disability in developed countries. Anyone suspected of having a stroke should be taken immediately to a medical facility for diagnosis and treatment. The symptoms that follow a stroke aren't significant and depend on the area of the brain that has been affected and the amount of tissue damaged. Parameters for predicting long-term outcome in such patients have not been clearly delineated, therefore the aim of this study was to investigate this possibility and to test a system that might practically be used routinely to aid management and predict outcomes of individual stroke patients.

**METHODS:** A descriptive hospital-based study of the neurological symptoms and signs of 503 patients with ischemic stroke, including severe headache, seizure, eye movement disorder, pupil size, Glasgow Coma Scale (GCS), agitation were analyzed in this study.

**RESULTS:** In the current study, dilated pupils, agitation, acute onset headache, lower GCS score, seizure, and eye gaze impairment had significantly higher prevalence in hemorrhagic stroke patients ($P<0.001$). However, the rate of gradual progressive headache is significantly higher in ischemic stroke patients ($P<0.001$).

**CONCLUSION:** Although this result provides reliable indicators for discrimination of stroke types, imaging studies are still the gold standard modality for diagnosis.

**KEY WORDS:** Stroke; Neurologic manifestations; Statistical model

## INTRODUCTION

In the developed world, cerebrovascular accidents (CVA) is the third leading cause of death after heart diseases and cancers,[1–3] and is the most common cause of morbidity and prominent disability in survivors,[1,2] where, 20% of patients will be in need of medical care and rehabilitation procedures in the few months after a CVA event.[1,2] On the other hand, CVA wastes a significant proportion of health care system budget.[4]

Two types of brain stroke are hemorrhagic and ischemic. Hemorrhagic stroke, which is due to blood vessel rupture, accounts for 20% of CVAs. Ischemic stroke due to brain vessels occlusion and blockage includes 80%.[1,2]

In order to prevent complications and permanent defects, early diagnosis is the key in stroke patients, however, distinguishing the type of stroke plays a crucial role in patient care. Simple clinical findings are helpful in distinguishing the type of stroke,[1,2] but need for diagnostic imaging is an undeniable fact.[5–9] Non-contrast computed tomography (CT) scan is the most commonly used modality to distinguish two types of stroke, but it is not accessible in all hospitals and emergency departments, which may lead to loss of treatment golden time.[2–22]

According to this issue, many studies described various clinical findings especially neurological signs and symptoms, and some of them presented formulas to distinguish stroke types based on clinical evaluations. These characteristics including focal or non-focal symptoms, negative or positive symptoms and sudden or gradual onset result in primary segregation of stroke types in emergency department that leads to early diagnosis and treatment. However, previous studies claimed that, neurological signs such as eye gaze and pupil size changes, can be reliable facts to distinguish stroke types.[1–3]

Regarding this issue, in the present study, we aim to identify the rate of neurological findings, such as eye signs and symptoms and Glasgow Coma Scale (GCS) changes in stroke patients and evaluate their prevalence in each type of stroke, in order to introduce a guidance to distinguish stroke types that can be more advantageous in districts without CT scan possibility. On the other hand, in developing countries, imaging facilities are not available in most of the small districts and towns, where early diagnosis of ischemic stroke can lead to early patient referral to centers with fibrinolytic therapy facilities and decrease in stroke injuries.

## METHODS

In the present descriptive study, one stroke center, including Imam Reza hospital with 24 hour access to CT scan, enrolled. As a pilot study designed to determine the prevalence of current study variables in stroke patients referred to these centers, the study group population calculated to be at least 500 patients. In a two-year period, from 2012 to 2013, all patients with neurologic defects complaint with or without decreased level of consciousness were included in our study. Patients with underlying diseases such as, metabolic deficiencies, trauma, and toxicity or peripheral nervous system disorders were excluded. Emergency department (ED) physicians clarified their diagnosis on the type of stroke during the first visit after admission, based on clinical findings. The presence of impaired eye gaze, GCS level, pupils' size, anisochoria and agitation were carefully examined.

All data including age, sex and examinations, were given to ED physicians in designed checklists. Non-contrast CT (NCT) was performed in order to confirm the diagnosis in all patients, which is the standard modality to distinguish hemorrhagic and ischemic stroke rapidly. Ninety-five percent of subarachnoid hemorrhages

(SAHs) and parenchymal hemorrhage, that are larger than 1 cm, are definable with brain NCT scan. However, most of the time, infarct lesions are not visible in CT scan in the 6–12 hours time window, and according to the infarct area size, in 1/3 of ischemic CVA patients, rapid onset and mild changes are detectable in CT scan study after approximately 3 hours of signs and symptoms onset. Checklists, along with the computed tomography reports, were used to perform calculations and analysis. In order to analyze demographic and clinical data, chi square test was used for qualitative variables and *t*-test for quantitative variables.

All patients' data were protected and they were free to leave the study at any stage, however, there were no fees charged for patients participated in study.

## RESULTS

Out of 503 patients with stroke diagnosis admitted to emergency department in one center, mean age (SD) was 68.45 (8.76), and the ages range was from 28 to 92 years. About 46.1% of patients were female, and 53.1% were male. The diagnosis was hemorrhagic stroke in 144 patients and ischemic stroke in 359 patients.

Acute headache and agitation were the most prevalent manifestations, that were present in 140 (27.8%) and 139 (27.6%) patients. Eye gaze impairment, seizure and gradual headaches were present in 89 (17.7%), 29 (5%) and 9 (3.8%) patients respectively. During pupil examination, midriatic pupil was observed in 223 (44.3%) patients, and only 2 (0.4%) patients had miosis.

Mean age of patients, each sex proportion and patients manifestations were separated by their diagnosis as listed in Tables 1–3.

In order to distinguish stroke type regarding to clinical examinations especially neurological manifestations, the following variables were studied and analyzed: GCS, acute onset headache, progressive headache, agitation, pupil size, and seizure.

**Table 1.** Demographic information of hemorrhagic and ischemic strokes patients, admitted to Emam Reza hospital emergency department during 2012–2013

| Variables | Number | Percentage |
|---|---|---|
| Sex | | |
| Male | 271 | 53.9 |
| Female | 231 | 46.1 |
| Lesion type | | |
| Ischemic | 359 | 71.4 |
| Hemorrhagic | 144 | 28.6 |

**Table 2.** Clinical manifestations of hemorrhagic and ischemic strokes patients, admitted to Emam Reza hospital emergency department during 2012–2013

| Variables | Number | Percentage |
|---|---|---|
| Acute onset headache | 140 | 27.8 |
| Gradual headache | 19 | 3.8 |
| Agitation | 139 | 27.6 |
| Pupils size | | |
| Miotic | 2 | 0.4 |
| Midriatic | 223 | 44.3 |
| Normal | 278 | 55.3 |

**Table 3.** Comparing clinical manifestations between hemorrhagic and ischemic strokes patients, admitted to Emam Reza hospital emergency department during 2012–2013

| Variables | Ischemic | Hemorrhagic | Total | P value |
|---|---|---|---|---|
| Acute onset headache | | | | 0.000 |
| Quantity | 147 | 140 | 7 | |
| Percentage in group | 27.8 | 92.4 | 1.9 | |
| Percentage of total | 27.8 | 26.4 | 1.4 | |
| Gradual headache | | | | 0.020 |
| Quantity | 19 | 1 | 18 | |
| Percentage in group | 3.8 | 0.7 | 5.0 | |
| Percentage of total | 3.8 | 0.2 | 3.6 | |
| Agitation | | | | 0.000 |
| Quantity | 25 | 25 | 0 | |
| Percentage in group | 5.0 | 17.4 | 0.0 | |
| Percentage of total | 5.0 | 5.0 | 0.0 | |
| Pupils' size | | | | 0.000 |
| Miotic | | | | |
| Quantity | 2 | 2 | 0 | |
| Percentage in group | 0.4 | 1.4 | 0.0 | |
| Percentage of total | 0.4 | 0.4 | 0.0 | |
| Midriatic | | | | |
| Quantity | 223 | 125 | 98 | |
| Percentage in group | 44.3 | 86.8 | 27.3 | |
| Percentage of total | 44.3 | 24.9 | 19.5 | |
| Normal | | | | |
| Quantity | 278 | 17 | 261 | |
| Percentage in group | 55.3 | 11.8 | 72.7 | |
| Percentage of total | 55.3 | 3.4 | 51.9 | |

According to GCS records, mean GCS (SD) score in ischemic stroke patients was 12.67 (0.81), however, the minimum score was 7 and the maximum was 15. Though, in hemorrhagic stroke patients, mean (SD) GCS score was 8.97 (0.182), with minimum of 6 and maximum of 15 (independent sample test $P<0.001$).

During examination, eye gaze impairment was present in 24 (6.7%) ischemic stroke patients and 65 (45.1%) hemorrhagic stroke patients (chi-square test $P<0.001$). Totally 261 (72.7%) patients among those with an ischemic stroke had normal pupil, but 98 (27.3%) patients had midriatic pupils during examinations. However, midriatic pupils was present in 125 (86.8%)

hemorrhagic stroke patients, while 11 (11.8%) were normal, and only 2 (1.4%) patients had miotic pupil (Chi square test $P<0.001$). Anisocoria was detected only in 10 (2%) patients of this study group and all of them were hemorrhagic stroke victims (6.9%). Out of 503 patients, only 25 (5%) had seizure manifestation, and all of them belonged to the hemorrhagic stroke group (17.4%) (Chi square test $P<0.001$).

Agitation prevalence was 6.7% among ischemic stroke patients (24 patients) and 79.9% among hemorrhagic patients (115 patients) (Chi square test $P<0.001$). Seven (19%) patients with acute onset headache were in the ischemic stroke group, and 133 (92.4%) patients with acute onset headache symptoms were in the hemorrhagic stroke group. After being scanned, CT scan reports in ischemic stroke patients claimed, hypo dense lesion in 324 (90.3%) patients, hyper dense artery sign in 328 (91.4%) patients, sulcus effacement in 6 (1.7%) patients, and mass effect in 2 (0.6%) patients. However, in all hemorrhagic stroke patients ($n$=144) hyper dense lesion was visible.

## DISCUSSION

Cerebrovascular accident (CVA) includes any vascular injury that diminishes brain and its derivatives blood flow, and causes various degrees of neurologic dysfunction and disability. Recently, CVA is the third leading cause of death after heart diseases and cancers in the Western world and it affects 700 000 person annually.[1–3,5] In addition, CVA leads to morbidity and prominent disability in 15%–30% of survivors,[1,2] and 20% of patients will require rehabilitation procedures.[1,2] CVA accounts for a significant quota of healthcare budgets and causes excessive healthcare expenses as well. Mortality during hospital admission is 15% and up to 20%–25% during the next 30 days. Although, 50%–70% of the patients recover from the neurological dysfunctions, 15%–30% of stroke victims suffer permanent disabilities.[5–7] Twenty percent of brain strokes are hemorrhagic, which are due to blood vessel rupture, and 80% are ischemic followed by brain vessels occlusion and blockage due to thrombosis or atherosclerosis.[1–2]

There are two types of hemorrhagic stroke, which are intracranial hemorrhage (ICH) and subarachnoid hemorrhage (SAH). Hypertension (HTN), myocardial infarction (MI), thrombolytic consumption are the most common risk factors for hemorrhagic stroke onset.[2] Hemorrhagic strokes have a wide spectrum of clinical manifestations, though acute onset headache, vomiting

and severe increases in blood pressure are the most prevalent signs and symptoms, that lead to localized neurological signs, developing in a few minutes.[1,9] Although, these signs and symptoms are not specific for any type of stroke, previous studies proved that, occurrence of acute manifestations most likely propounds the probability of hemorrhagic stroke.

There are three main etiology described for ischemic stroke including, hypo-perfusion, embolism, and thrombosis, which is the most common reason. Signs and symptoms in these patients can be slowly progressive, and can develops over several hours with variable severity.[2] Various manifestations can be present as a result of ischemic stroke, including paresis, ataxia, paralysis, vomiting, and eye gaze, however, occurrence site of these signs depends on the brain area that is being nourished by suffering vessels.[1,2]

Immediate diagnosis and treatment may dramatically diminish the rate of neurological impairment in patients after CVA, and differentiating the type of stroke plays a crucial role in patient management and treatment.[1–2] Although, non-contrast computed tomography scan (NCT scan) is a widely used modality to exclude the presence of hemorrhage in stroke victims due to its ability to prove hemorrhage in first hours after CVA, it is not accessible in all hospitals and emergency departments.[16–22] Early diagnosis is important in stroke patients to prevent permanent defects. Although, the need for diagnostic imaging in distinguishing stroke types is an undeniable fact, in units without imaging facilities, clinical findings can be helpful in distinguishing types of stroke.[1,2,9]

Results corresponding with previous studies, claim that study group patients were fine representatives of stroke victims, and this fact indicates that the current study results are applicable to all stroke patients.

In the current study, ischemic stroke diagnosis was the most prevalent stroke type. According to pathophysiology of the CVA, mean age of patients with ischemic stroke was higher than hemorrhagic stroke patients, as expected.[20]

In the current study, statistical analysis claimed that lower GCS scale, agitated mood, acute onset headache, seizure, and midriatic pupil had a higher prevalence in hemorrhagic strokes, which was similar to the Besson study.[20] Comparing the prevalence in the two group of stroke patients showed a significant relation between hemorrhagic stroke onset and these clinical manifestations in patients (*P*<0.001). This fact suggests that the presence of these signs and symptoms can strongly suggest the type of stroke and help ED physician in primary diagnosis making. On the other hand, since

manifestations in ischemic stroke progress over several hours, gradual headache had a higher prevalence in ischemic strokes. Also in this study, occurrence of this symptom propounds more probability of ischemic stroke in patients (*P*<0.001).

After all, though clinical manifestations are helpful in distinguishing stroke types during primary visit, imaging is still the gold standard diagnostic method for brain stroke patients. However, in small district hospitals and centers, where imaging facilities are not accessible, these results can be applicable for patient management, treatment and timely referral to stroke center.

## CONCLUSION

In the current study, various clinical manifestations of different types of CVA are evaluated, in order to distinguish hemorrhagic and ischemic strokes that categorize the signs and symptoms by their prevalence in each type of stroke. Even though the results proved significant correlation between stroke types and specific clinical findings, further studies are required to identify each manifestation's value in stroke type anticipation. It may be better to use some new scoring such as NIHSS in combination with the signs and symptoms.

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